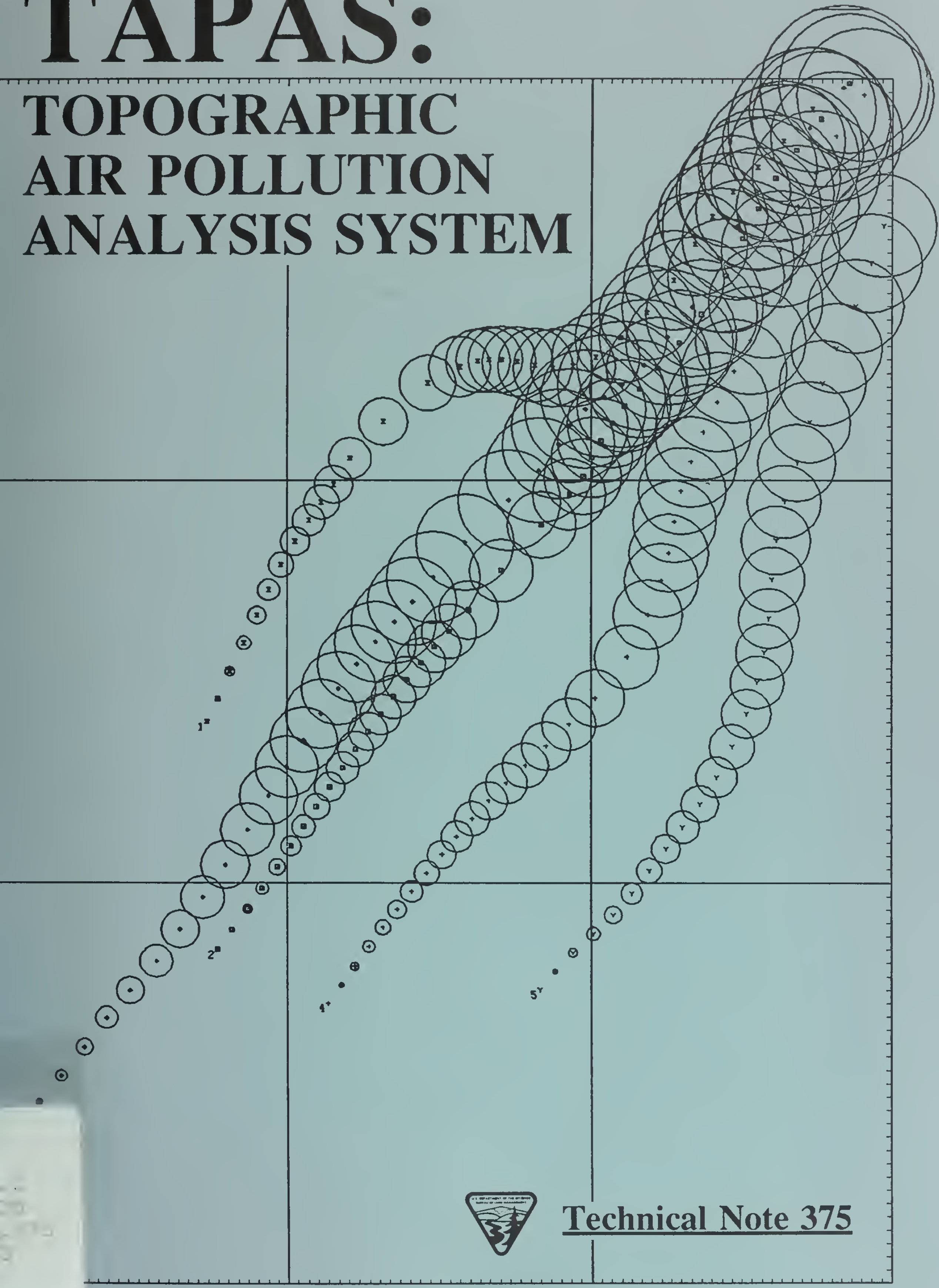
TAPAS:

TOPOGRAPHIC AIR POLLUTION ANALYSIS SYSTEM



Technical Note 375

United States Department of the Interior

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BLM Technical Note 375 presents information on the Topographic Air Pollution Analysis System (TAPAS), currently under development by the BLM, U.S. Forest Service, and Colorado State University. TAPAS is designed to provide resource managers with air quality dispersion modeling tools to accomplish more efficient and economical air resource studies.

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TAPAS:

TOPOGRAPHIC AIR POLLUTION ANALYSIS SYSTEM

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TAPAS applications include support for resource management plans, environmental impact statements, siting of remote automatic weather stations, PSD permit evaluations, and smoke management for prescribed burns.

Questions about Tech Note 375 may be addressed to BLM author Al Riebau at the Wyoming State Office (307-772-2068, FTS 328-2068). Additional copies are available from:

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1 Attachment
1 - TAPAS: Topographic Air Pollution Analysis System

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INTRODUCTION

As part of its multiple-use mission, the Bureau of Land Management (BLM) manages and develops natural resources including vegetation, timber, wildlife habitat, soils, and minerals. Minerals development, prescribed burning, and wildfire control can adversely affect air quality. Federal laws and regulations mandate protection of the Nation's air quality and require that BLM:

1) identify and evaluate air quality issues in planning documents, and
2) select resource alternatives that minimize or mitigate adverse impacts to air resources.

Effective air resource analysis and climate data measurement are essential to effective management of air quality. The use of models to predict atmospheric pollutant impacts and dispersion potentials has long been the only recognized tool in air quality analysis.

Modeling employs physical or mathematical representations of conditions found in nature. Air quality dispersion modeling uses computer-based mathematical functions to depict atmospheric conditions and variables, allowing resource managers to predict air quality impacts from proposed actions or alternatives.

Air resource models manipulate data from a variety of sources. In a typical use, meterologic and geographic (e.g., elevation/contour) data are first combined to simulate wind flow over a given terrain. This flow ranges from simple depictions to complex three-dimensional wind field simulations for every hour of the year over a large and varied geographic region. Pollutants are then entered into this simulation, and their dispersion calculated in time and space. This depiction can also range from simple to complex, where the user may specify for complex chemical reactions and highly involved dilution regimes within detailed regional wind fields.

The Federal Land Policy and Management Act (FLPMA), the Clean Air Act, and the National Environmental Policy Act (NEPA) set goals for the Nation's air resources, and require Federal agencies to conduct their activities in such a way that air quality is not impaired or that applicable standards are not exceeded. BLM Manual 7300[1] provides specifics on the Bureau's air resource program, including field office roles and responsibilities.

This Technical Note presents information on the Topographic Air Pollution Analysis System (TAPAS), currently under development by the BLM, U.S. Forest Service and Colorado State University. TAPAS is designed to provide BLM resource specialists with tools to accomplish more efficient and economic air resource studies. Compared to existing modeling systems, TAPAS can:

-- lower analysis costs,
-- equal or surpass products offered by contractors,
-- simplify the operation of air quality models,
-- insure the repeatablilty of model runs, and
-- increase their flexibility of operation.

TAPAS is a group of interactive air quality computer modules that can be operated independently, or in combination for more detailed applications (Fox, et al. 1987). Using TAPAS, analyses can be applied to a wide range of applications, thus allowing modeling technology to support a greater range of Bureau activities. For example, Federal land managers have used TAPAS air flow (wind field) models to ensure that climatological equipment is placed where measurements are representative of large areas–rather than restricted, localized conditions.

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[1] At time of publication, in preparation and review by BLM's Washington Office.

APPLICATIONS

Several applications of TAPAS have proven useful to BLM, including support for:

- -- Resource Management Plans,
- -- Environmental Impact Statements,
- -- Smoke management for prescribed burns,
- -- RAWS siting, and
- -- PSD permit evaluations

Resource Management Plans. TAPAS was used in the development of a Resource Management Plan (RMP) for the Kemmerer Resource Area, Rock Springs District, Wyoming. The Kemmerer area contains vast amounts of natural gas. This gas, however, is contaminated by hydrogen sulfide (H_2S), a highly toxic substance which is removed by a "sweetening" process before the gas can be marketed. One of BLM's concerns was how this resource should be managed to insure public safety and to protect sensitive resources.

Several new issues arose out of these concerns. The process of sweetening releases sulfur oxides, which help form acid rain. Sweetening plants in southwestern Wyoming are generally upwind of the acid-sensitive Bridger and Fitzpatrick Wilderness areas, designated as Class I areas under the Clean Air Act. Class I areas require the most stringent protection of air resources; *Prevention of Significant Air Quality Deterioration* (PSD) regulations are summarized in BLM Manual 7300, Air Resources Program.

The BLM and U.S. Forest Service used TAPAS to devise a monitoring plan to track acidic substances deposition in the wilderness areas and plan the development of natural gas in the RMP. Figure 1 is a computer-drawn contour map of the Rock Springs area used in this RMP. Data used in drawing this map came from the TAPAS terrain data base which covers the contiguous U.S. at a resolution of 30 seconds latitude and longitude. TAPAS modeling also delineated areas of poor dispersion potential (by overlaying computed wind velocity vector fields, Figure 2) which were identified in the RMP to guide the location of natural gas developments (Figure 3) to avoid any potential public danger from the release of H_2S during a well blowout (Riebau, et al. 1986). In addition, five hypothetical pollution sources were placed in the Resource Area to point out areas where, should future emission sources be constructed, transport of pollution into wilderness areas could be estimated (Figure 4). Information from the TAPAS-modeled poor dispersion potential was overlayed with other resource data to identify H_2S risk areas for the Kemmerer RMP (Figure 5; map in back pocket).

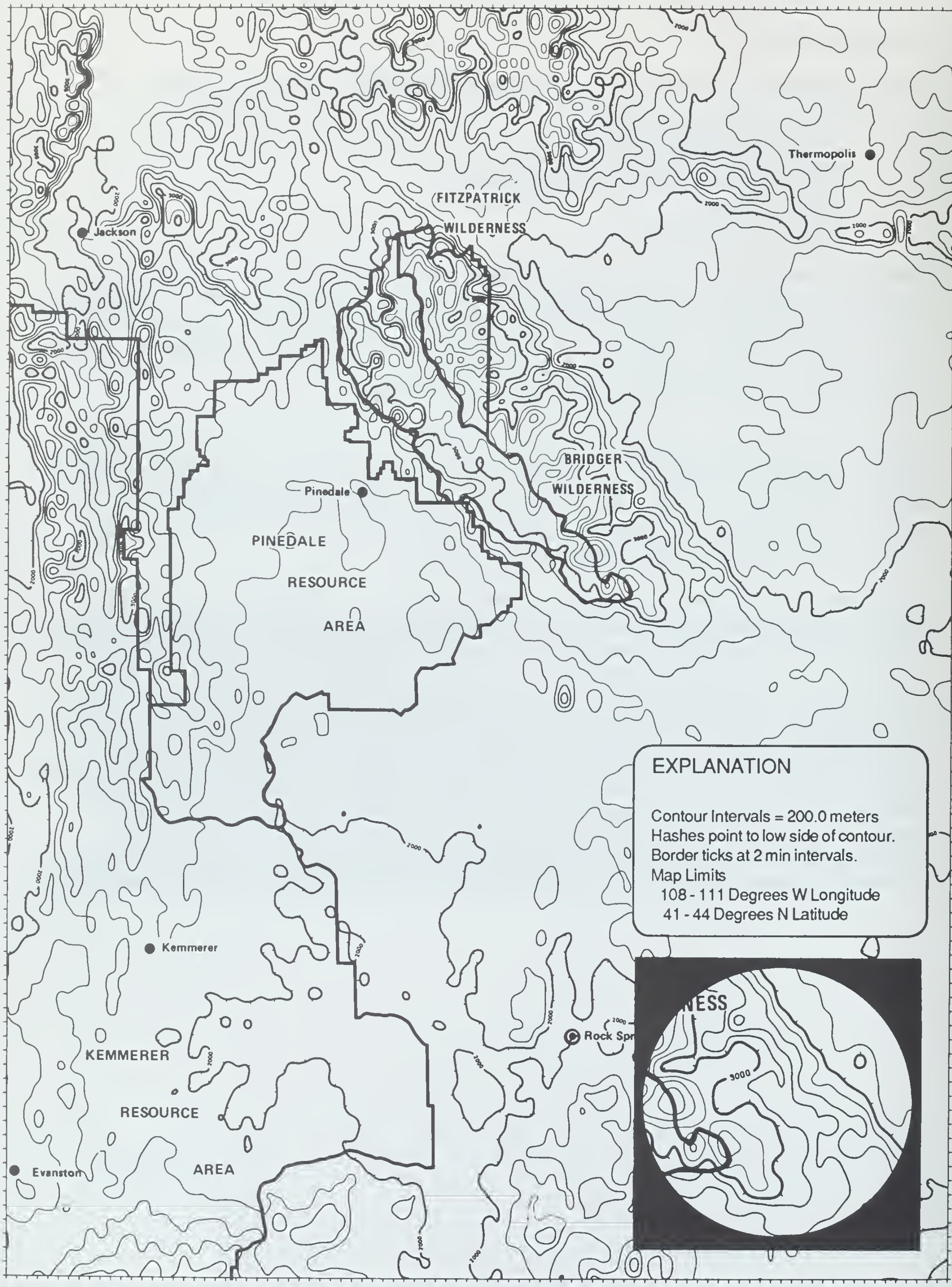

Figure 1. Contour map with BLM Resource Areas and U.S. Forest Service wilderness areas.

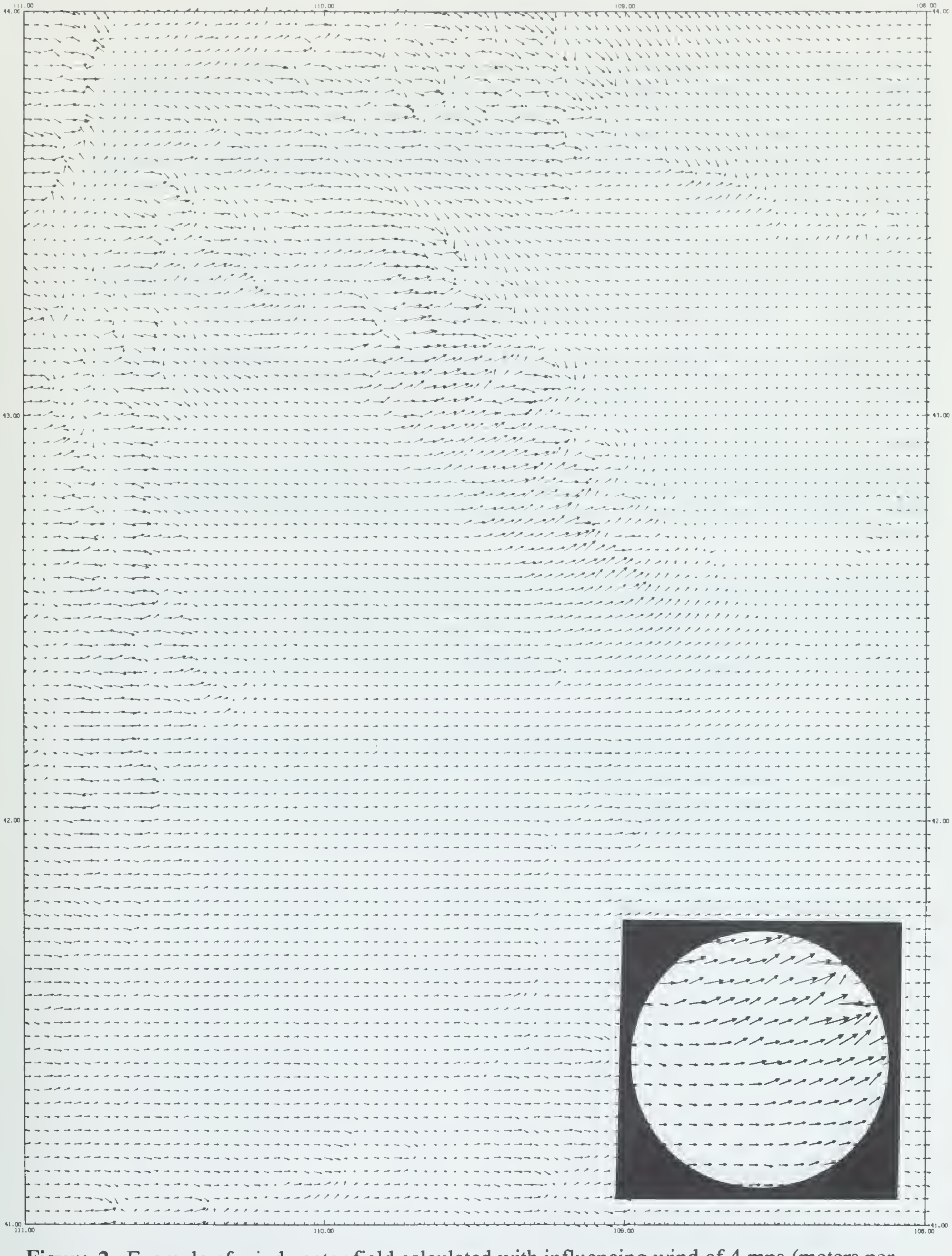

Figure 2. Example of wind vector field calculated with influencing wind of 4 mps (meters per second) from the west at E stability (relatively stable atmosphere).

Environmental Impact Statements. TAPAS modeling was also conducted to project the potential air quality impacts from proposed tar sand and oil shale development in Colorado, Utah, and Wyoming. Again, new resource management issues were brought before BLM in concerns expressed over acid rain (atmospheric deposition) and other impacts to wilderness areas. In the largest air modeling effort ever undertaken for an EIS, projected emissions from planned projects were modeled over the tri-state area to assess potential ambient concentrations against air quality standards.

Visibility and wilderness ecosystem effects from atmospheric deposition (acid rain) and ambient pollution concentrations were also analyzed. These analyses were used to support the Prototype Oilshale EIS and air quality technical reports for both this EIS and the preliminary draft Federal Oil Shale Management Program EIS (Dietrich, et al. 1982, 1983).

TAPAS was used in Colorado to map dispersion potential (actually the stagnation potential where dispersion is often limited) among coal lease tracts in northeastern Colorado to rank them during the planning and leasing processes.

Smoke Management. TAPAS was used to predict the final trajectory of a smoke plume resulting from a BLM-prescribed burn in Wells, Nevada. It has also been tested in BLM's Salem District, Oregon to simulate complex, three-dimensional maritime-influenced wind fields. In addition, a new smoke management module is being developed and tested for fire managers.

RAWS Siting. A fourth highly successful use of TAPAS has been to aid in the placement of remote automatic weather stations (RAWS) in Wyoming, Colorado, and Utah. Wind field vector plots were used to determine if station sites were representative of a broad general area or merely localized meteorological terrain-influenced conditions. In this manner, it was assured that RAWS were placed to gain maximum utility from each station for fire, minerals, wildlife, and range management programs.

PSD Permit Evaluations. TAPAS modules have been useful in estimating the impacts of air pollution and atmospheric deposition on the air-quality values of wilderness areas. Permit applications are evaluated using TAPAS models to consider additional projected impacts. TAPAS has also been used to predict effects of air pollution on natural resources such as water quality in alpine lakes and visibility reductions on long-range vistas.

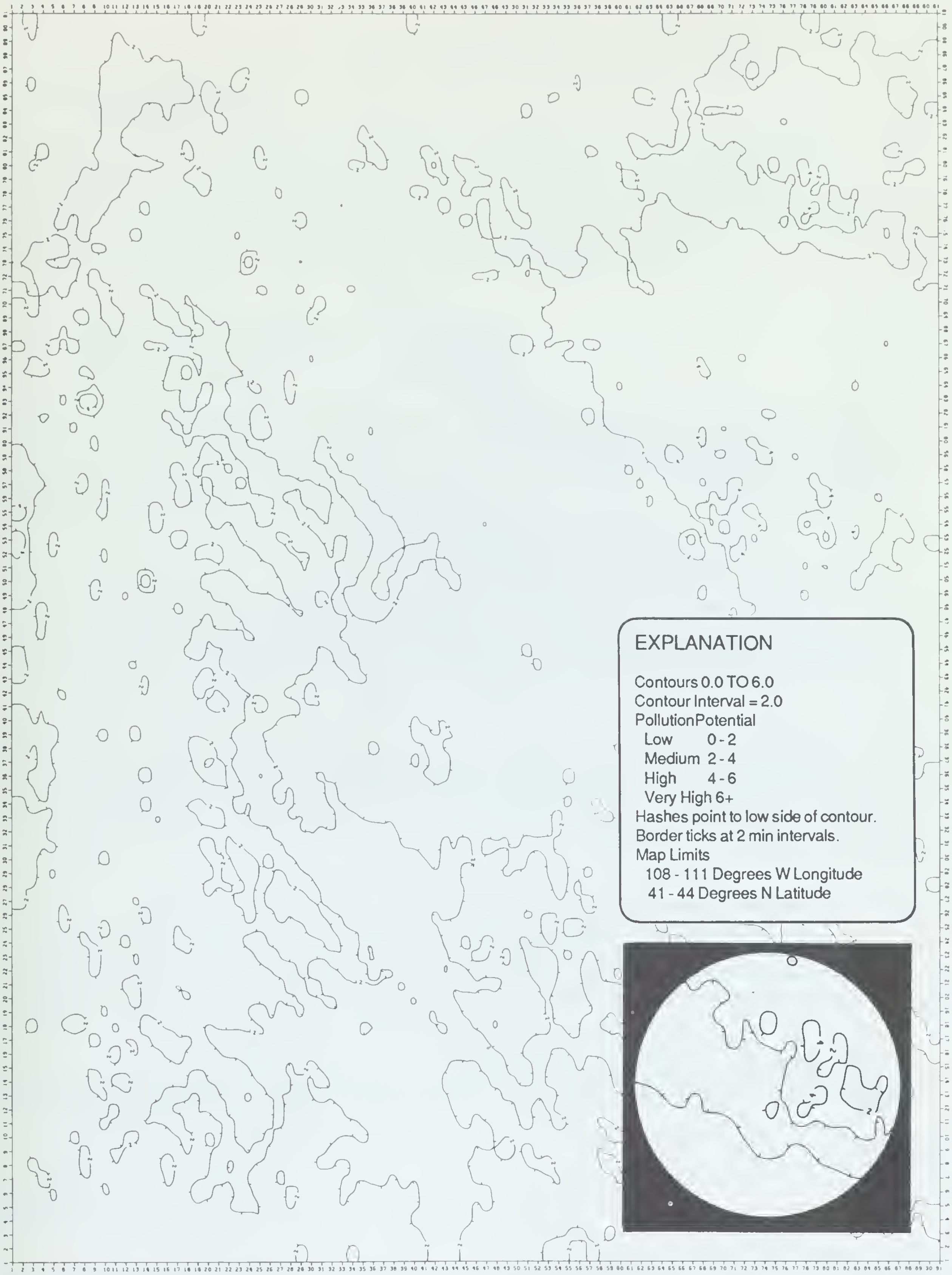

Figure 3. Pollution potential–resistance of atmoshpere to disperse pollutants–calculated for F stability (very stable atmospheric conditions), a worst-case scenario. Created by overlaying velocity vectors for wind speeds occurring under the stability class.

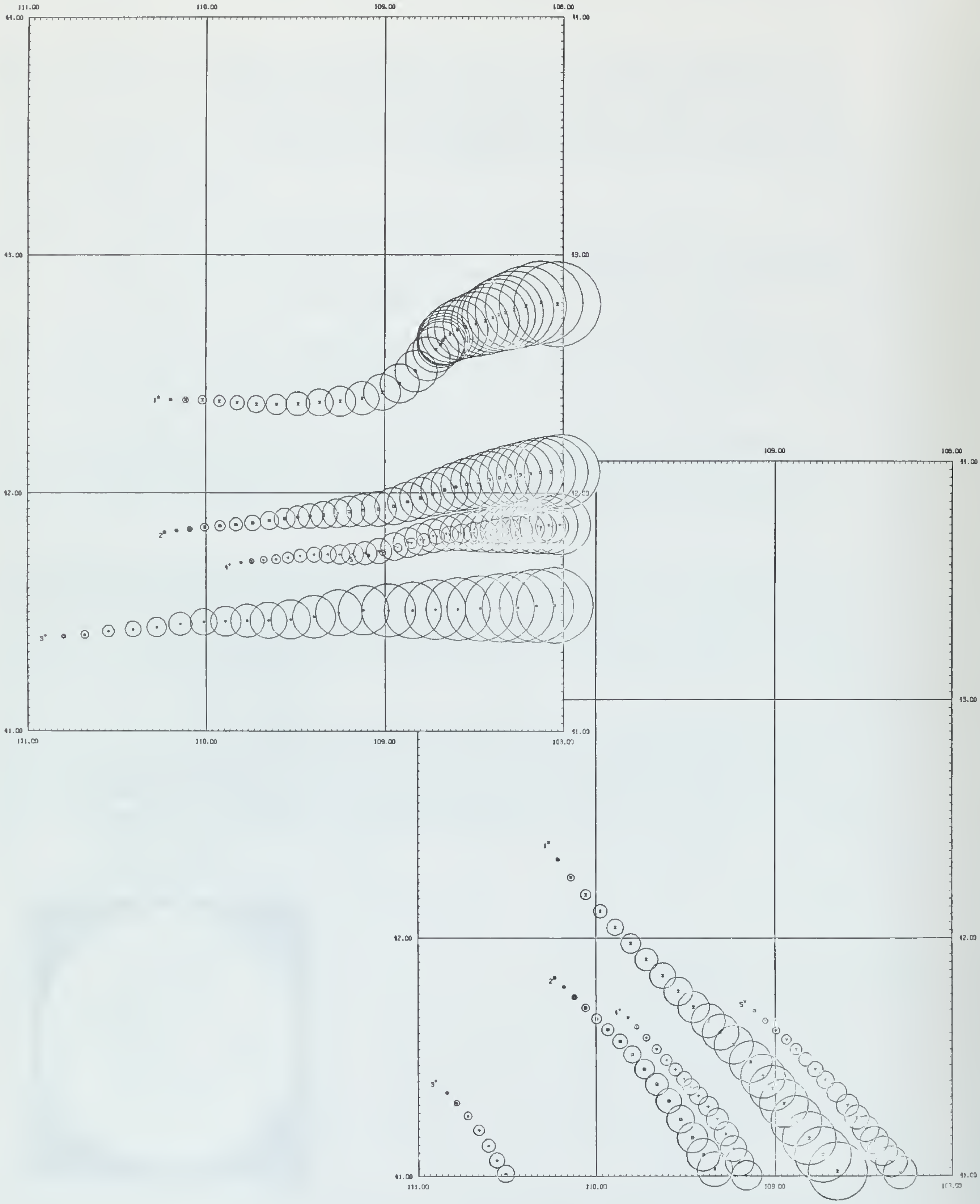

Figure 4. Estimated plume trajectories for five hypothetical sources using calculated velocity vector fields for steady-state west and northwest winds, frequent and less frequent winds in the area. This modeling can be done for any type of wind regime.

SYSTEM COMPONENTS

TAPAS is a modular computer software system designed for use by field personnel with limited computer experience (Figure 6). As such, it is a family of air resource analysis tools which can be applied to wide ranges of management problems. TAPAS allows its users to switch from one module to another and not become lost in the matrix of the operating system. Modeling can thus progress from simple screening techniques to advanced, complex analyses as the occasion demands. Four of the primary TAPAS components are:

Terrain Data Management
Wind Field Simulations
Puff Trajectory Modeling, and
Dispersion Modeling

Terrain Data Management. TAPAS permits contour data to be selected from any area of the continental United States. Users need only select the longitude and latitude of four corners of the analysis area (not necessarily square) and the density of grid-point spacing. These simple geographic inputs are used to generate an elevation contour data file. These data can then be plotted to form a two- or three-dimensional contour map of the analysis area. The elevation file is also used as input data for other TAPAS components (Figure 1 is an example).

Wind Field Simulations. TAPAS can simulate wind speed and direction over large areas in two or three dimensions using the models **WINDS** or **NUATMOS**. These models use terrain data generated by the Terrain Data Management module and meteorological data entered interactively or via data file by the user. Wind field results can be then printed in tabular form or plotted as vectors or streamlines. Consistent structure throughout each subsection of the module allows quick turnaround on repetitive model runs (Figure 2 is an example).

Puff Trajectory Modeling. Using wind field data, TAPAS can project where pollutant plumes from continuously emitting sources (such as a power plant or refinery) will travel through the complex wind patterns experienced in the equally complex landforms of the western United States. Ground-level pollutant concentration data can be represented in tabular form by TAPAS and the path of plumes over the countryside presented graphically (Figure 4 is an example).

Dispersion Modeling. TAPAS also contains interactive versions of many common and less-complex EPA **UNAMAP** series models used by industry for receiving permits to construct new air pollution emission sources. Agency specialists can use these models to check the accuracy of industrial applications for proposed sources using the same methods as will ultimately be submitted to air quality regulators. These models can also be used for screening analyses to support lower-impact BLM actions.

TAPAS also has other modules to assess impacts to visibility, from acid rain and other effects. Also included in the system are modules to aid the management and archiving of modeling data and the mathematical reduction of meteorological data.

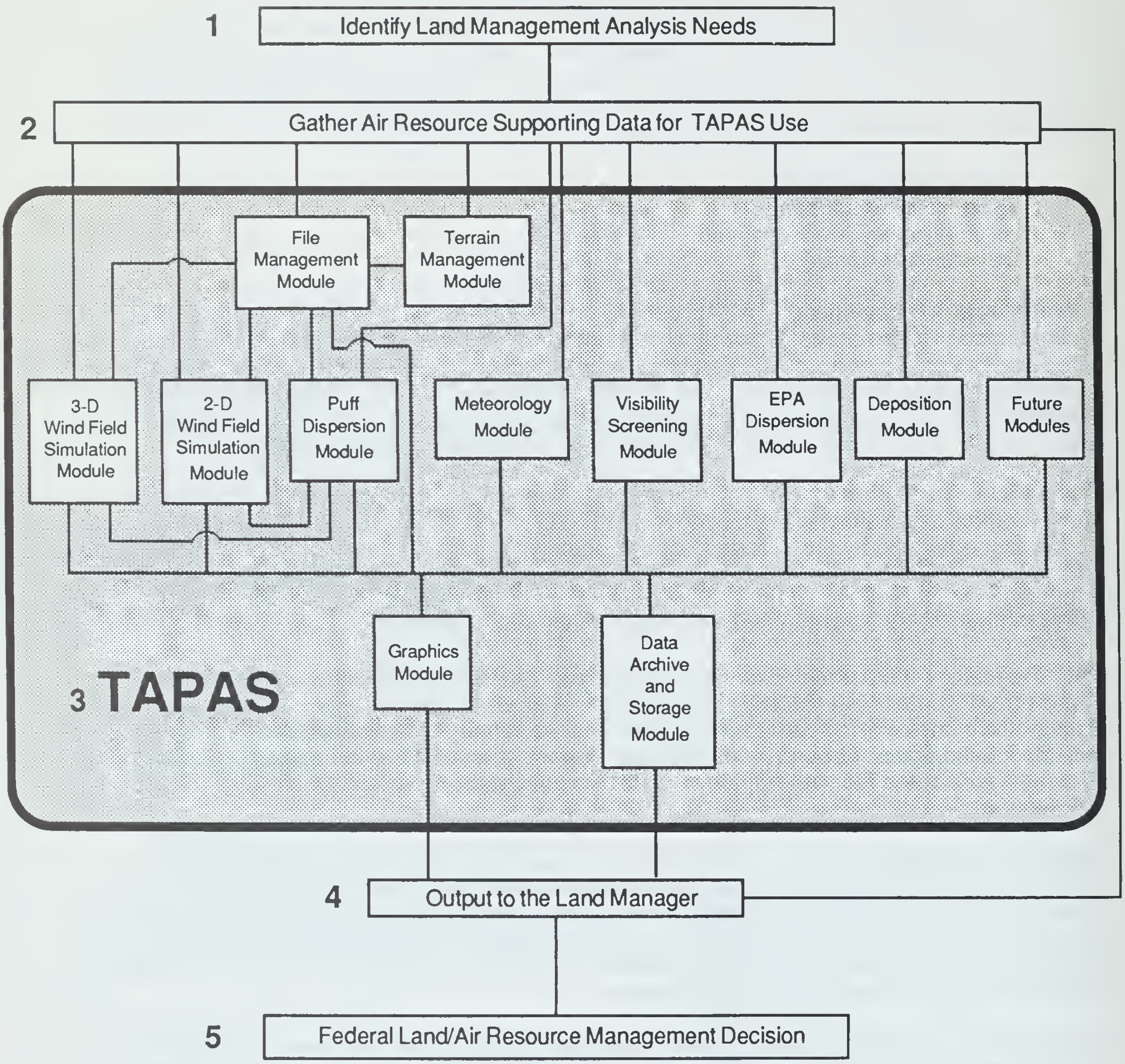

Figure 6. BLM air resource management process, including TAPAS modules.

FUTURE DEVELOPMENTS

At present, TAPAS resides on Control Data computers at the Colorado State University. Development of a minicomputer version executing on Data General MV series machines will be completed in early 1987. Several new products are also under development, including:

- -- modules for screening air quality impacts from secondary growth,
- -- a regional haze visibility impact assessment module, and
- -- a smoke management module that will consist of models to aid in the proper management of prescribed burning.

Training, consultation, and assistance in using TAPAS are available from the Air Resources Specialist at BLM's Wyoming State Office (currently Al Riebau, FTS 328-2068, commercial [307] 772-2068). This office conducts TAPAS development activities with the Forest Service and Colorado State University, and sets up computer accounts for users of the system.

CONCLUSION

TAPAS is a modular system designed to aid federal land managers in a variety of resource management applications. Due to its modular nature, new modeling tools or updates of existing tools can be inserted for use by specialists without loss of use of other system components. TAPAS allows users to move from operation of one module to another with relative ease. This philosophy also allows users of varying expertise to produce usable products using less complex systems components and then progress to more complex applications. As a BLM/USFS in-house operational tool, it is now possible for agency specialists to apply air resource modeling to a wider variety of Bureau activities, many of which were previously prohibited due to contractual costs.

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16. Abstract (Limit: 200 words)

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Computer models
Air quality dispersion
Modeling tools
Air quality computer models

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LINCOLN COUNTY, WYOMING
STAR VALLEY
Salt River
Willow Creek
Crow Creek
R 46 E
R 119 W
R 118 W

Map 8
GEOLOGIC HAZARDS, CRITICAL EROSION AREAS, H2S FIELDS, POLLUTION POTENTIAL, AND UTILITY CORRIDORS
Kemmerer Resource Management Plan